

ZOOLOGY.—*The new planktonic foraminiferal genus Tinophodella, and an emendation of Globigerinita Bronnimann.* ALFRED R. LOEBLICH, JR., and HELEN TAPPAN, Smithsonian Institution.

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In a study of Recent foraminiferal faunas, specimens were obtained which at first appeared to be referable to *Globigerinita naparimaensis* Bronnimann. Further examination showed that two distinct types were represented, and a restudy of Bronnimann's type specimens showed that both had been included by him in *G. naparimaensis*. As these types differ morphologically, the genus *Globigerinita* Bronnimann is here restricted to include only those species like the holotype of *G. naparimaensis*, the type species, and a new generic name is proposed for those which differ morphologically from that species as thus restricted. Various earlier writers have also separated specifically these two morphologic types in Recent deposits. Rhumbler (1909) described and illustrated specimens like the holotype of *G. naparimaensis* (= *Globigerinita*, s.s.) as the species *Globigerina lamellosa* Terquem. As noted by LeCalvez (1949, p. 38) and Parker (1954, p. 476), Terquem's species is quite unlike the present form. Parker recorded this latter type as *Globigerina* sp., stating that it was similar in many respects to *Globigerinita*, but probably "represents a new genus". Apparently she considered as typical *Globigerinita*, the paratypes there referred by Bronnimann, and did not consider the holotype of that species, which is morphologically more like her *Globigerina* sp., although specifically distinct.

Rhumbler (1909) recorded specimens similar to the paratypes of *G. naparimaensis* (not = *Globigerinita*, s.s.) as *Globigerina glutinata* Egger, although Egger's original description and figures appear to represent a distinct species of true *Globigerina*.

Phleger, Parker, and Pierson (1953, p. 16) followed Rhumbler's interpretation and recorded *Globigerinita glutinata* (Egger) as widely distributed in the North Atlantic, as did Parker (1954, p. 477), who recorded it as present in some abundance in the north-eastern Gulf of Mexico.

The genus *Globigerinita* is therefore here emended and restricted, and the new generic name *Tinophodella* is proposed to include certain other forms that have been erroneously referred to *Globigerinita*.

Family ORBULINIDAE Schultze, 1854

Genus *Globigerinita* Bronnimann, 1951, emended
Globigerinita Bronnimann, Contr. Cushman Found. Foram. Res. 2 (pt. 1): 18 (part). 1951.

Type species.—*Globigerinita naparimaensis* Bronnimann, 1951. Fixed by original designation and monotypy.

Test free, trochospiral, early chambers spherical to ovate, final chamber modified and extending on the umbilical side across the umbilical region; sutures depressed, radial; wall calcareous, perforate, radial in structure, surface smooth or hispid; primary aperture interiomarginal and umbilical, in the final stage this primary aperture is covered by the modified final chamber which extends across the umbilical region and is replaced by one or more small arched supplementary apertures at the umbilical margin of the final chamber.

Remarks.—*Globigerinita* differs from *Globigerina* d'Orbigny in the presence of a modified final chamber which extends on the umbilical side to cover the earlier primary aperture and the umbilicus. *Tinophodella*, new genus, differs in having a distinct and separate supplementary plate over the umbilicus, extending somewhat along the sutures, with numerous accessory apertures along all margins.

In addition to the type species, *Globigerinita naparimaensis* Bronnimann, *Globigerina quinqueloba* Natland, and the new species here described as *G. parkerae* are referable to this genus.

Range.—Miocene to Recent.

Globigerinita naparimaensis Bronnimann,
restricted

Globigerinita naparimaensis Bronnimann (part),
Contr. Cushman Found. Foram. Res. 2 (pt. 1):
18, text figs. 1, 2 (not figs. 3-14). 1951.

Not *Globigerinita naparimaensis* Bronnimann,
Conato, Riv. Ital. Pal. Strat. 60 (1): 30, pl. 3,
figs. 1-12. 1954.

Remarks.—Bronnimann (1951, p. 18) originally included in *Globigerinita naparimaensis*, a specimen with a modified final chamber and double aperture on the umbilical side (the holotype) and also other specimens (paratypes) which have a distinct umbilical-sutural "supplementary" chamber, with numerous accessory apertures around its periphery. The two forms were present in the same strata and were considered to be conspecific. As, in other horizons, the planktonic assemblage may include only one or the other type, they appear to be distinct and are here separated. The holotype of the present species (Bronnimann, 1951, text figs. 1, 2) has a modified final chamber which covers the *Globigerina*-like aperture of the previous chamber, and itself has two supplementary apertures at its umbilical margin. The true characters are well shown in Bronnimann's original figures of the holotype, and the species is here restricted to include only morphologically similar specimens.

The paratypes figured by Bronnimann (1951, text figs. 3-14) differ from the holotype in having a distinct supplementary plate over the umbilical and apertural region. This plate does not resemble the true chambers as does the umbilically expanded modified final chamber of true *Globigerinita*. These paratypes of *G. naparimaensis* are referable to the new genus and species, *Tinophodella ambitacrena*.

Types and occurrence.—Holotype (Cushman Coll. 64182) from the Lengua formation, *Globorotalia menardii* zone, Miocene, Naparima area, Trinidad, B. W. I. The species as here restricted is known only from the Miocene of Trinidad.

***Globigerinita parkerae* Loeblich and Tappan, n. sp.**

Figs. 1a-c

Globigerina lamellosa Terquem, Rhumbler (not Terquem, 1882), *Ergeb. Plankton-Exped. Humboldt-Stift.* 3: pl. 30, figs. 1-6. 1909.

Globigerina sp. F. Parker, *Bull. Mus. Comp. Zool.* 111 (10): 476. 1954.

Test free, tiny, trochospiral, compressed, sides flattened, periphery rounded, peripheral outline lobulate; chambers ovate to spherical, increasing slowly in size, 5 to 7 in the final whorl, with modified final chamber extending far onto the umbilical side to completely cover the umbilical region; sutures distinct, depressed, radial; wall calcareous, finely perforate, surface finely spinose; primary aperture in the early stages interior-marginal and umbilical, but that of the modified

final chamber is multiple, consisting of small arched supplementary openings around the extended umbilical margin of the final chamber.

Greatest diameter of holotype 0.21 mm, thickness 0.07 mm.

Remarks.—*Globigerina lamellosa* Terquem of Rhumbler (1909, pl. 30, figs. 1-6) is undoubtedly identical with the present species. However, Terquem's species was originally described from the Lutetian (middle Eocene) of the Paris Basin. The original illustration is poor and diagrammatic, and could represent any coiled form. It was described as having lamellar expansions from the later chambers which cover the apertural region. Le Calvez (1949, p. 38), stated that this species is not a *Globigerina*, and the type specimen of Terquem is in reality a *Discorbis*, analogous to *Rotalina coarctata* Terquem or *Rosalina propinqua* Terquem. She therefore considered (Le Calvez, 1949, p. 17) that *G. lamellosa* Terquem was a synonym of *Discorbis propinqua* (Terquem).

Parker (1954) recorded this species as *Globigerina* sp., although noting that it was similar to *Globigerinita*. She stated that it probably represented a new genus. However, it is similar to the holotype of *Globigerinita naparimaensis* Bronnimann having only a modified final chamber and lacking the secondary umbilical plate of the adult stage, such as is found in *Tinophodella ambitacrena*, new species.

Globigerinita parkerae, new species, differs from *G. naparimaensis* Bronnimann in being much smaller, with more chambers per whorl, and these are less closely appressed and show a more gradual increase in size.

The present species differs from *Globigerina quinqueloba* Natland in being much smaller, in having more chambers in the final whorl and a more gradual increase in chamber size, and more numerous supplementary apertures in the final chamber.

The specific name is in honor of Miss Frances Parker, Scripps Institution of Oceanography, La Jolla, Calif., in recognition of her work on Recent foraminiferal faunas.

Types and occurrence.—Holotype (U.S.N.M. P5897) from the Recent, eastern Gulf of Mexico, lat. 29°04' N., long. 85°49' W., depth 183 meters. Sample received from Frances Parker.

***Tinophodella* Loeblich and Tappan, n. gen.**

Type species.—*Tinophodella ambitacrena* Loeblich and Tappan, n. sp.

Derivation.—*Teino*, Gr., stretch, extend, spread + *phos*, *phodos*, Gr., blister + *ella*, diminutive. Gender, feminine.

Test free, trochospiral; chambers spherical to ovate; sutures depressed, radial; wall calcareous, perforate, radial in structure, surface smooth, pitted or hispid; primary aperture interiomarginal, umbilical, in the final stage the aperture is completely covered by an irregular plate which covers the umbilicus and expands along the earlier sutures, with numerous accessory apertures along the margins of the umbilical plate, both at the junction of the plate with the sutures of earlier chambers, and along the contact with the primary chambers.

Remarks.—This genus includes forms which have in the past been variously referred to *Globigerina* d'Orbigny, *Globigerinatella* Cushman and Stainforth and *Globigerinita* Bronnimann. As here emended, *Globigerinita* is now restricted to include only forms with a modified final chamber with supplementary apertures and the present genus differs in having a distinct umbilical plate with numerous small accessory apertures opening beneath its margin.

Globigerinoïta Bronnimann differs in having supplementary apertures on the spiral side which are also covered by small cover plates.

Range.—Miocene to Recent.

Tinophodella ambitacrena Loeblich and Tappan, n. sp.

Figs. 2a-3c

Globigerina glutinata Egger, Rhumbler (part, not Egger, 1893), *Ergeb. Plankton-Exped. Humboldt-Stift.* **3**: 148, pl. 29, figs. 15, 18-20, 22, pl. 34, fig. 1 (not pl. 29, figs. 14, 16, 17, 21, 23-26, and not pl. 33, fig. 20). 1909.

Globigerinatella aff. *insueta* Cushman and Stainforth, Bronnimann, *Contr. Cushman Found. Foram. Res.* **1**: (pts. 3-4): 82, pl. 14, fig. 11. 1950.

Globigerinita naparimaensis Bronnimann (part), *Contr. Cushman Found. Foram. Res.* **2** (pt. 1): 18, text figs. 3-14 (not text figs. 1-2). 1951; Conato, *Riv. Ital. Paleon. Strat.* **60** (1): 30, pl. 3, figs. 1-12. 1954.

Globigerinita glutinata (Egger), Phleger, Parker, and Pierson (part), *Rept. Swedish Deep-Sea Exped.* **7** (1): 16, pl. 2, fig. 15 (not figs. 12-14). 1953; Parker, *Bull. Mus. Comp. Zool.* **111** (10): 477. 1954.

Test free, inflated, low trochospiral, with broadly rounded periphery; chambers inflated, globular, increasing rapidly in size, early whorls

with 4 to 5 chambers per whorl, rapidly reducing to 3 per whorl, which is most common in the adult; sutures distinct, depressed, radial; wall calcareous, finely perforate, surface finely spinose; primary aperture interiomarginal, umbilical, in the adult covered by a thin-walled umbilical plate which extends along the sutural depression over most of the umbilical side, and may even extend slightly onto the spiral side, outer margin of the umbilical plate with numerous accessory apertures which lie against the primary chambers and over the sutures as well, to open beneath the umbilical plate.

Greatest diameter of holotype 0.35 mm, thickness 0.25 mm.

Remarks.—The specific name is from the Latin *ambitus*, circumference + *crena*, notch, rounded projection. The name refers to the crenulated appearance of the border of the umbilical plate, caused by the accessory apertures.

Rhumbler (1909) referred this form to *Globigerina glutinata* Egger, but the latter species appears to be a true *Globigerina*, and shows no trace of a supplementary chamber on the umbilical side. Rhumbler also included specimens of *Globigerinoïdes* under Egger's species, but these differ in having supplementary apertures on the spiral side, as well as in lacking the umbilical cover plate.

Phleger, Parker, and Pierson (1953) followed Rhumbler's interpretation of Egger's species, but placed it in the genus *Globigerinita*. They also included specimens of a distinct species of *Globigerinoïdes* under this name.

Bronnimann (1950) figures a specimen of the present species as *Globigerinatella* aff. *insueta* Cushman and Stainforth, and the following year (1951) included it in the synonymy of *Globigerinita naparimaensis*. All figured paratypes of *G. naparimaensis* belong to the present species, as they differ in their apertural character from the holotype. Other writers have also recorded the present species as *G. naparimaensis* (i.e., Conato, 1954), but true *G. naparimaensis* is known only from the Miocene of Trinidad, having a modified final chamber, but no true cover plate.

The present species occurs in the Miocene of Trinidad, Pliocene of Italy, and Recent of the North and South Atlantic and the Gulf of Mexico.

Types and occurrence.—Holotype (U.S.N.M. P5898) and figured paratype (U.S.N.M. P5899) from the Recent, *Albatross* station D 2763, off the east coast of Brazil, lat. 24°17'00" S., long.

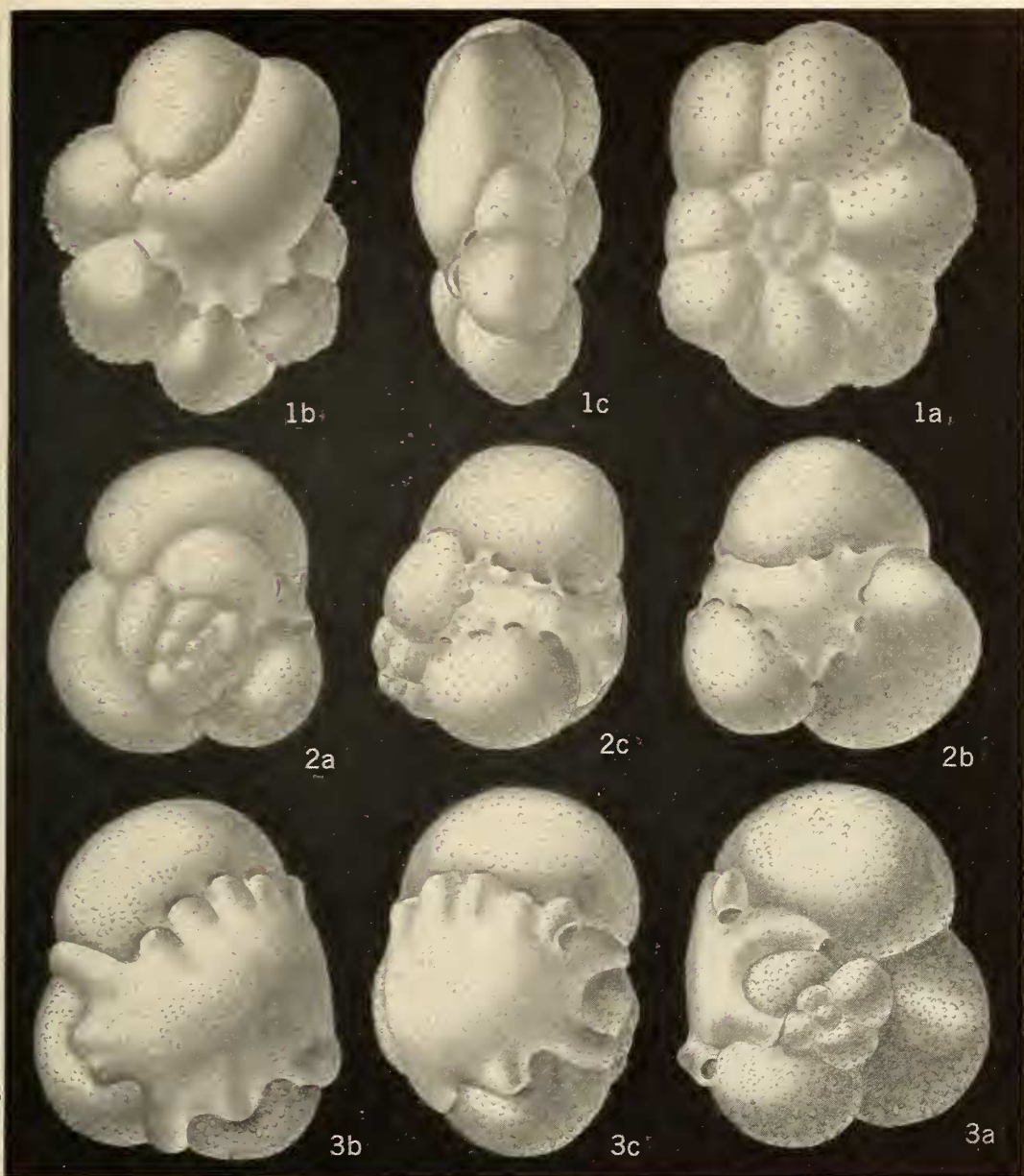


FIG. 1.—*Globigerinita parkerae* Loeblich and Tappan, n. sp., holotype (U.S.N.M. P5897): *a*, Spiral side, showing normal appearing final chamber; *b*, umbilical side, showing modification of the final chamber, and extension over the umbilical-apertural region, and the numerous supplementary apertures at its margin; *c*, edge view, showing compressed form. $\times 280$.

FIGS. 2, 3.—*Tinophodella ambitacrena* Loeblich and Tappan, n. gen., n. sp.: *a*, Spiral side; *b*, umbilical side; *c*, edge. 2, Paratype (U.S.N.M. P5899), showing relatively small umbilical cover which is distinct from the true chambers, and occupies the umbilical-sutural area. 3, Holotype (U.S.N.M. P5898), showing extensive umbilical cover plate and distinctly crenulated margin, due to the numerous accessory apertures. $\times 145$.

Illustrations are shaded camera-lucida drawings by Patricia Isham, scientific illustrator, Smithsonian Institution.

42°48'30" W., depth 671 fathoms. Surface temperature 75°F., bottom temperature 37.9°F. Brown *Globigerina* ooze.

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 WEIGHT OF METEORITE

The great shooting star that plunged to earth thousands of years ago and dug the famous Arizona Meteorite Crater weighed at least 12,000 tons (the size of an average house) and approached from a direction slightly south of west. Hitherto it has been estimated that the giant meteorite weighed between 10,000 and 10,000,000 tons, and that it crashed to earth from a point slightly west of north. These most recent measures of weight and direction are based on an on-the-spot study by scientists of the Smithsonian Astrophysical Observatory headed by Dr. John S. Rinchart, assistant director of the observatory.

Direction of the meteorite's flight was determined by sampling earth over an 80-square-mile area for tiny fragments of the meteorite. These particles of metals were found distributed over a symmetrical swath running nearly west to east (actually 15° north of east). Samples were taken every half mile in a square pattern, and sifted by screen and magnetic separator. Particles adhering to the magnet were all strongly magnetic and mainly in three categories: a meteoric

iron particle, a meteoric iron-oxide bit, and a shiny particle probably volcanic.

From the area immediately surrounding the crater—which is 4,100 feet in diameter and about 600 feet deep—the scientists sampled earth that contained a concentration of meteorite particles. The weight of these particles, taking into consideration the area over which they were collected, constituted the basis for estimating the 12,000-ton weight of the meteorite.

Dr. Rinehart points out that a ballistics estimate previously made determined that the missile would have had to weigh 12,000 tons to have made a crater of the dimensions of the one in Arizona. His report on the survey states that there is no evidence to indicate any sizable portion of the meteorite lies under the floor of the crater. The meteor apparently exploded on impact, scattering into bits and chunks. The larger pieces remain now as particles, and the original smaller pieces have undoubtedly disintegrated through oxidization since the meteor fell thousands of years ago. The time is estimated variously at from 5000 to 50,000 years ago.

The true logic for this world is the calculus of probabilities, the only mathematics for practical men.—MAXWELL.